

Predictors of Earnings Risk with Machine Learning

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December 17, 2025

Abstract

This paper looks at the determinants of lifetime earnings risk under a Restricted Income Profile (RIP) model using traditional and machine learning methods such as lasso and SHAP values. The paper builds on the work of Drewianka and Oberg (2025) which uses a moment condition approach derive a parameter that captures permanent income risk. The paper finds that education and age are important in explaining lifetime earnings risk. The paper also finds that macroeconomic variables such as probability of recession and real GDP growth are important and along with state controls may further imply a role of government policy. Finally, the paper finds that occupation controls are important while industry controls do not appear to play a strong role.

Keywords: machine learning, restricted income profile, earnings instability, risk

JEL Codes: D8, J0, D3

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1. NEED TO ADD INFO ABOUT WHICH DUMMIES WERE INCLUDED IN STEPWISE REGRESSIONS SINCE THEY ARE SUPPRESSED ON THE TABLE
2. NEED TO ADD IN AND OCD Lasso, and of all of lasso for that matter
3. NEED TO ADD IN SHAP VALUE FIGURES
4. ONLY HAVE 25k observations and Scott had 62900

1 Introduction

2 Data and Model

3 Empirical Strategy

4 Results

5 Conclusion

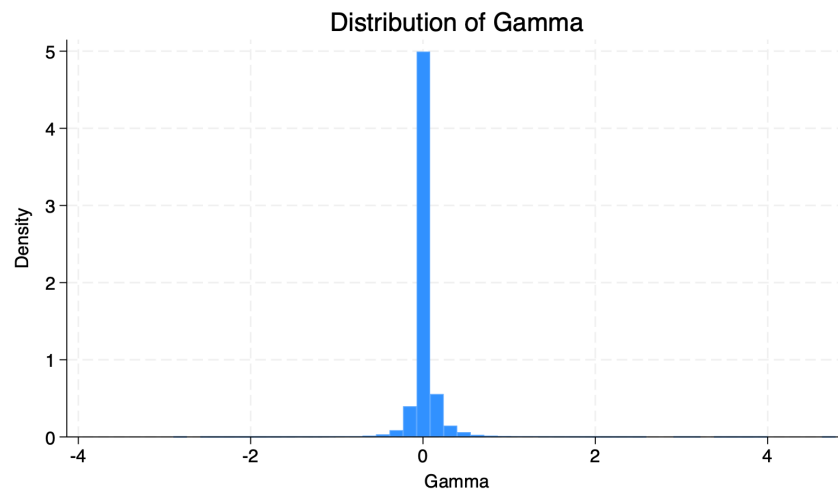


Figure 1: Distribution of Gamma

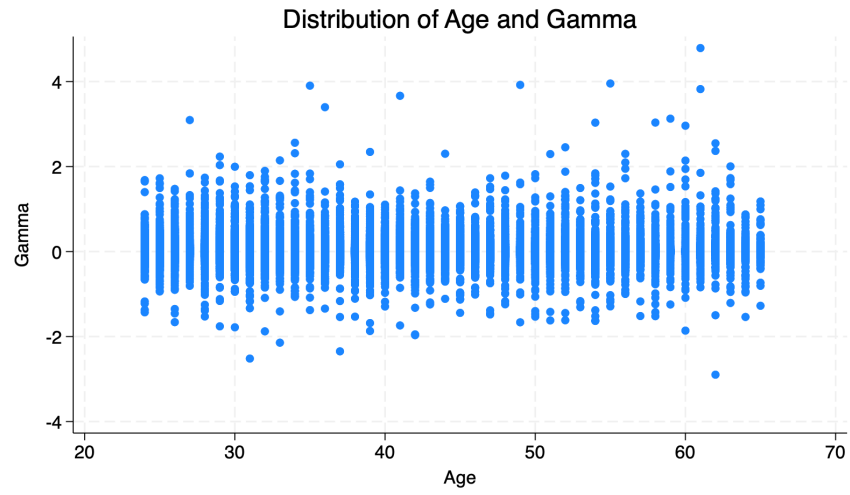


Figure 2: Scatterplot of Age vs. Gamma

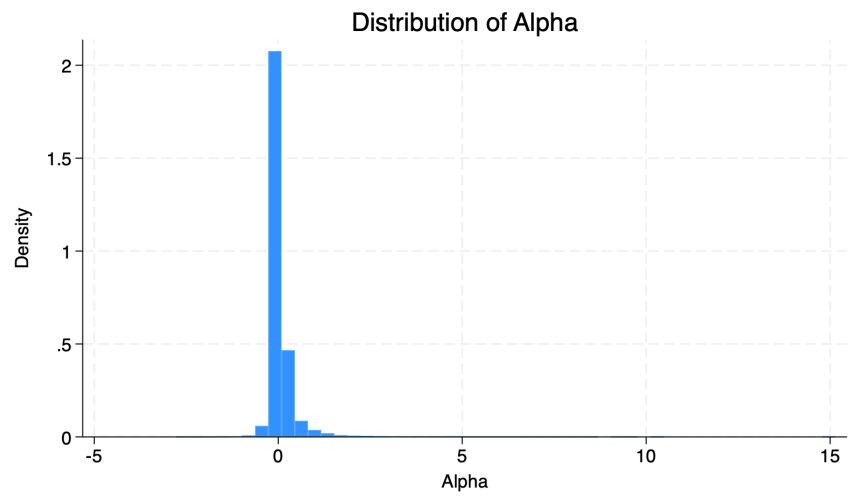


Figure 3: Distribution of Alpha

Table 1: Gamma Regressions: OLS Results

	(1)	(2)	(3)	(4)	(5)
	Gamma	Gamma	Gamma	Gamma	Gamma
Less than High School	-0.0115*** (0.00215)	-0.0107*** (0.00232)	-0.0117*** (0.00242)	-0.0109*** (0.00253)	-0.0117*** (0.00255)
High School Graduate	-0.00918*** (0.00144)	-0.00854*** (0.00149)	-0.00902*** (0.00158)	-0.00812*** (0.00171)	-0.00850*** (0.00173)
Some College	-0.00746*** (0.00170)	-0.00681*** (0.00172)	-0.00736*** (0.00177)	-0.00674*** (0.00184)	-0.00695*** (0.00185)
Probability of Recession	0.0000422 (0.0000437)	-0.0104 (0.0179)	-0.0000953 (51.52)	-0.0000817 (51.50)	-0.0000292 (51.49)
Real GDP growth rate	0.000600 (0.000400)	-0.00432 (0.00325)	-0.0000211 (3.981)	-0.000186 (3.979)	-0.000626 (3.979)
5-year moving average of AEP	0.0000636* (0.0000295)	0.0000629 (0.0000322)	0.0000374 (0.0000340)	0.0000766* (0.0000347)	0.0000688 (0.0000356)
Out of Labor Force	-0.00430 (0.00535)	-0.00410 (0.00536)	-0.00471 (0.00573)	-0.00461 (0.00572)	-0.00474 (0.00572)
Tenure	-0.0000438 (0.0000888)	-0.0000336 (0.0000963)	0.0000277 (0.0000981)	0.00000375 (0.0000984)	0.0000156 (0.0000987)
Age	0.00592* (0.00269)	0.00650* (0.00273)	0.00679* (0.00274)	0.00679* (0.00274)	0.00671* (0.00274)
Age Squared	-0.000170** (0.0000651)	-0.000193** (0.0000659)	-0.000196** (0.0000662)	-0.000197** (0.0000662)	-0.000194** (0.0000663)
Age Cubed	0.00000153** (0.000000509)	0.00000172*** (0.000000515)	0.00000173*** (0.000000517)	0.00000173*** (0.000000518)	0.00000171*** (0.000000518)
State FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Race FE	No	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	Yes	Yes
Industry FE	No	No	Yes	No	Yes
R-squared	0.001	0.002	0.003	0.005	0.006
N	82357	82333	81556	81556	81556

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Gamma Regressions: Stepwise Selection Results

	(1)	(2)	(3)	(4)	(5)
	Gamma	Gamma	Gamma	Gamma	Gamma
Less than High School	-0.0110*** (0.00211)	-0.0110*** (0.00211)	-0.0101*** (0.00205)	-0.0108*** (0.00234)	-0.0110*** (0.00236)
High School Graduate	-0.00904*** (0.00143)	-0.00905*** (0.00143)	-0.00840*** (0.00143)	-0.00829*** (0.00166)	-0.00834*** (0.00168)
Some College	-0.00740*** (0.00169)	-0.00740*** (0.00169)	-0.00731*** (0.00172)	-0.00723*** (0.00182)	-0.00725*** (0.00183)
Age	0.00571* (0.00268)	0.00568* (0.00268)		0.00594* (0.00270)	0.00566* (0.00270)
Age Cubed	0.00000150** (0.000000508)	0.00000149** (0.000000508)	0.000000439*** (8.71e-08)	0.00000150** (0.000000511)	0.00000143** (0.000000511)
5-year moving average of AEP	0.0000579* (0.0000286)	0.0000577* (0.0000286)		0.0000788* (0.0000316)	0.0000732* (0.0000324)
Age Squared	-0.000165* (0.0000650)	-0.000165* (0.0000650)	-0.0000282*** (0.00000578)	-0.000168* (0.0000654)	-0.000161* (0.0000654)
Constant	-0.0391 (0.0358)	-0.0387 (0.0358)	0.0395*** (0.00358)	-0.0414 (0.0360)	-0.0380 (0.0360)
State FE					
Year FE					
Race FE					
Cohort FE					
Occupation FE				✓	✓
Industry FE			✓		✓
State FE Available	No	Yes	Yes	Yes	Yes
Year FE Available	No	Yes	Yes	Yes	Yes
Race FE Available	No	Yes	Yes	Yes	Yes
Cohort FE Available	No	Yes	Yes	Yes	Yes
Occupation FE Available	No	No	No	Yes	Yes
Industry FE Available	No	No	Yes	No	Yes
R-squared	0.001	0.001	0.002	0.003	0.004
N	82357	82333	81556	81556	81556

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Gamma Regressions: Lasso Selection Results

	No Controls	No Occ/Ind	No Occ	No Ind	All Controls
EDU1	2	3	3	2	2
EDU2	1	2	2	2	2
EDU3	3	4	4	4	3
OLF	9	9	8	7	6
PrRecess	10				
currentage	8	7	6	5	4
currentagecube	4	8	7	6	5
currentagesq	11	10	10	9	8
ma5aep	5	5	5	3	3
rGDPgrow	6				
tenure	7	6	9	8	7
State FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Race FE	No	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	Yes	Yes
Industry FE	No	No	Yes	No	Yes

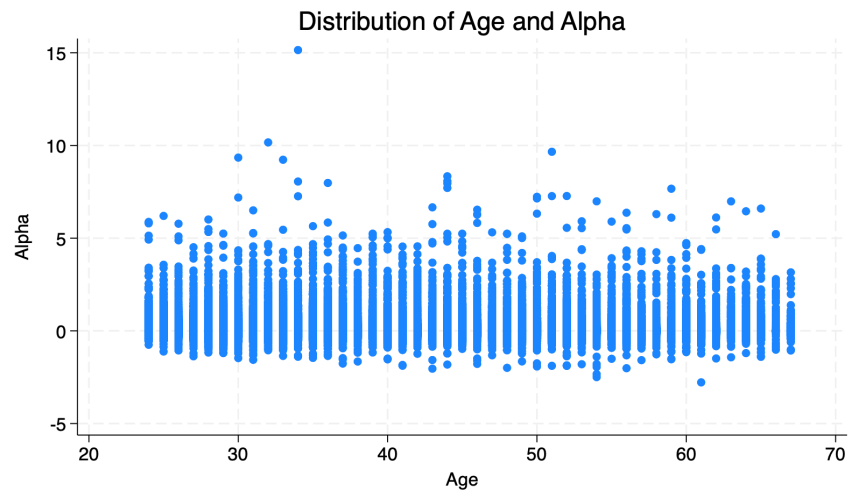


Figure 4: Scatterplot of Age vs. Alpha

Table 4: Alpha Regressions: OLS Results

	(1) Alpha	(2) Alpha	(3) Alpha	(4) Alpha	(5) Alpha
Less than High School	-0.0268*** (0.00451)	-0.0240*** (0.00487)	-0.0308*** (0.00508)	-0.0278*** (0.00531)	-0.0301*** (0.00535)
High School Graduate	-0.0131*** (0.00309)	-0.0129*** (0.00320)	-0.0136*** (0.00340)	-0.00909* (0.00368)	-0.0104** (0.00372)
Some College	-0.00240 (0.00366)	-0.00321 (0.00370)	-0.00223 (0.00384)	0.00135 (0.00398)	0.000562 (0.00401)
Probability of Recession	-0.0000420 (0.0000929)	-0.138* (0.0554)	-0.113 (0.0723)	-0.112 (0.0723)	-0.113 (0.0722)
Real GDP growth rate	-0.00144 (0.000855)	0.000541 (0.00633)	-0.00107 (0.00713)	-0.00287 (0.00710)	-0.00359 (0.00714)
5-year moving average of AEP	0.00127*** (0.0000616)	0.00138*** (0.0000669)	0.00103*** (0.0000712)	0.00111*** (0.0000726)	0.00106*** (0.0000745)
Out of Labor Force	0.113*** (0.0101)	0.111*** (0.0101)	0.0518*** (0.0111)	0.0521*** (0.0111)	0.0517*** (0.0111)
Tenure	-0.000698*** (0.000185)	-0.00000130 (0.000202)	0.000135 (0.000207)	0.0000259 (0.000208)	0.0000861 (0.000208)
Age	0.0165** (0.00520)	0.0183*** (0.00526)	0.0175*** (0.00530)	0.0182*** (0.00530)	0.0173** (0.00530)
Age Squared	-0.000398** (0.000124)	-0.000451*** (0.000125)	-0.000431*** (0.000126)	-0.000452*** (0.000126)	-0.000427*** (0.000126)
Age Cubed	0.00000324*** (0.000000947)	0.00000371*** (0.000000955)	0.00000356*** (0.000000963)	0.00000374*** (0.000000963)	0.00000353*** (0.000000964)
State FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Race FE	No	Yes	Yes	Yes	Yes
Cohort FE	No	Yes	Yes	Yes	Yes
Occupation FE	No	No	No	Yes	Yes
Industry FE	No	No	Yes	No	Yes
R-squared	0.008	0.013	0.020	0.021	0.023
N	102946	102910	100781	100781	100781

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Alpha Regressions: Stepwise Selection Results

	(1) Alpha	(2) Alpha	(3) Alpha	(4) Alpha	(5) Alpha
Less than High School	-0.0261*** (0.00418)	-0.0204*** (0.00450)	-0.0259*** (0.00464)	-0.0259*** (0.00477)	-0.0272*** (0.00480)
High School Graduate	-0.0122*** (0.00271)	-0.0108*** (0.00278)	-0.0107*** (0.00289)	-0.00852** (0.00304)	-0.00913** (0.00306)
Age Squared	-0.000401** (0.000124)	-0.000394** (0.000124)	-0.000336** (0.000125)	-0.000384** (0.000125)	-0.000351** (0.000125)
Age Cubed	0.00000326*** (0.000000947)	0.00000327*** (0.000000950)	0.00000287** (0.000000959)	0.00000321*** (0.000000959)	0.00000296** (0.000000959)
Real GDP growth rate	-0.00115* (0.000541)				
5-year moving average of AEP	0.00127*** (0.0000601)	0.00135*** (0.0000650)	0.00106*** (0.0000689)	0.00111*** (0.0000711)	0.00107*** (0.0000728)
Out of Labor Force	0.113*** (0.0101)	0.112*** (0.0101)	0.0535*** (0.0111)	0.0541*** (0.0111)	0.0535*** (0.0111)
Tenure	-0.000704*** (0.000185)				
Age	0.0167** (0.00519)	0.0159** (0.00523)	0.0132* (0.00527)	0.0153** (0.00527)	0.0140** (0.00527)
Constant	-0.190** (0.0704)	-0.157 (0.0825)	-0.102 (0.0831)	-0.117 (0.0831)	-0.105 (0.0831)
State FE		✓	✓	✓	✓
Year FE		✓	✓	✓	✓
Race FE		✓	✓	✓	✓
Cohort FE					
Occupation FE				✓	✓
Industry FE			✓		✓
State FE Available	No	Yes	Yes	Yes	Yes
Year FE Available	No	Yes	Yes	Yes	Yes
Race FE Available	No	Yes	Yes	Yes	Yes
Cohort FE Available	No	Yes	Yes	Yes	Yes
Occupation FE Available	No	No	No	Yes	Yes
Industry FE Available	No	No	Yes	No	Yes
R-squared	0.008	0.012	0.018	0.021	0.022
N	102946	102910	100781	100781	100781

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$